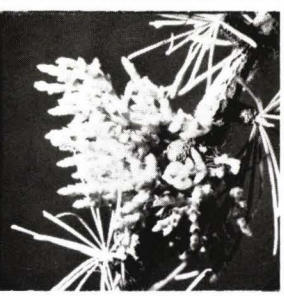
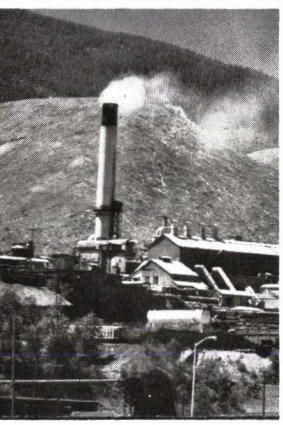
SB761
U7N6
77-10





FOREST INSECT & DISEASE MANAGEMENT

USDA · FOREST SERVICE · NORTHERN REGION

State & Private Forestry · Missoula, MT 59801

Report No. 77-10

5200
April 1977

EVALUATION OF A MOUNTAIN PINE BEETLE INFESTATION, GOLD CREEK DRAINAGE, REXFORD DISTRICT, KOOTENAI NATIONAL FOREST, MONTANA, 1976

by

D. R. Hamel, Entomologist, and R. D. Oakes, Biological Technician

ABSTRACT

A mountain pine beetle infestation developed in lodgepole pine stands in the Gold Creek drainage in 1974. From 1974 to 1976 approximately 19,000 trees with an estimated volume of 10,210 cu m were killed. Based on buildup ratios, stand structure, size of trees, and residual green stand, it is predicted that 5,756 trees will be killed in 1977. Three management alternatives are discussed and selective logging is recommended.

INTRODUCTION

A mountain pine beetle, *Dendroctonus ponderosae* Hopk., infestation developed in lodgepole pine (*Pinus contorta* var. *latifolia* Engelm.), 24 km southwest of Eureka, Montana (Figure 1) in 1974. Aerial surveyors mapped approximately 600 faders along the west shore of Lake Koocanusa in 1976. Ground examination in November indicated an increase in buildup ratios.

The Rexford District proposed three alternatives for management[1/]. Prior to prescribing or implementing a management plan, a pre-suppression survey was requested. The survey was conducted during

1/ Letter dated Nov. 10, 1976. E. Schultz, Ranger, Rexford District, Kootenai NF.

LIBRARY

JUN 10 1977

ROCKY MOUNTAIN STATION

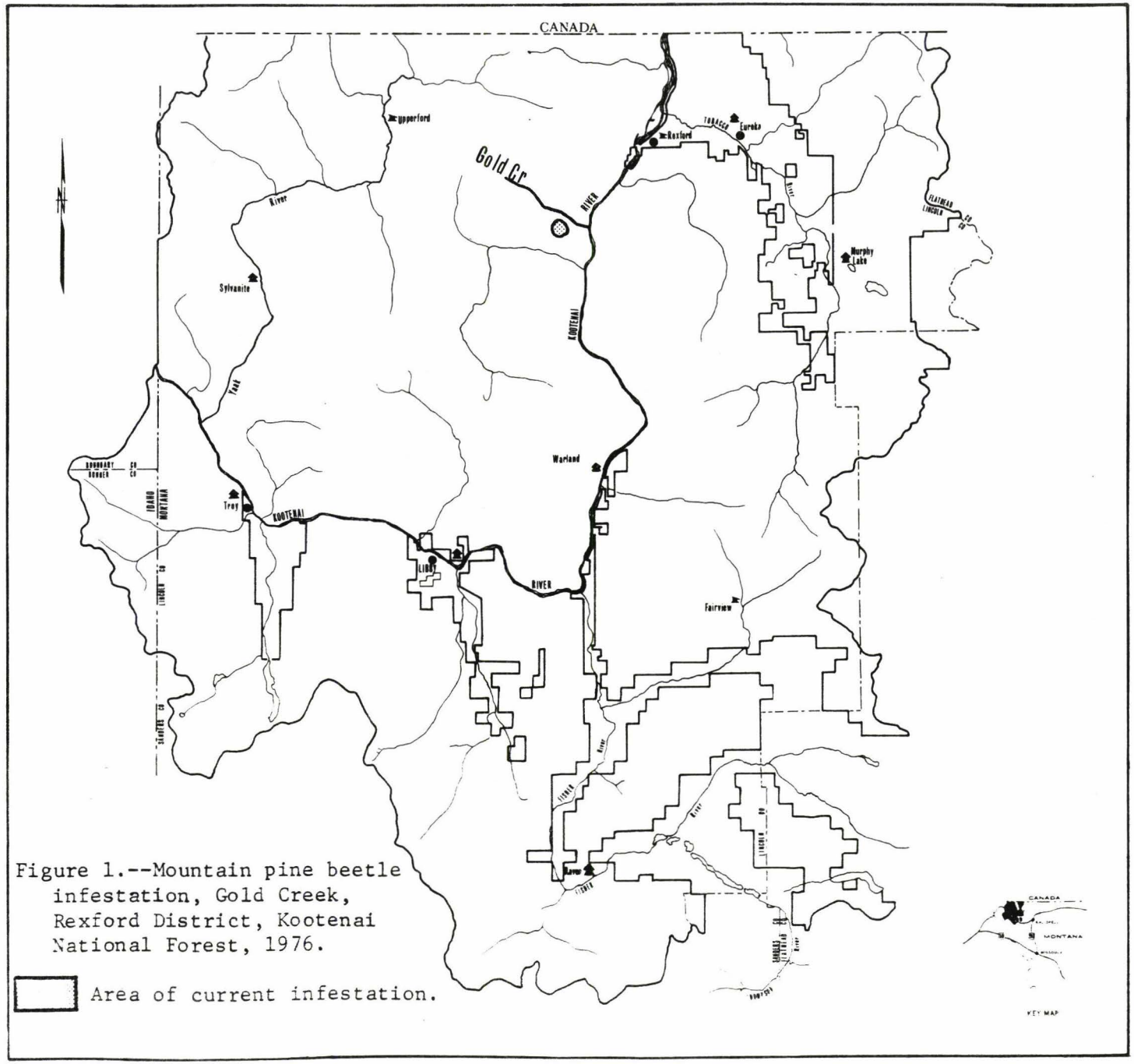


Figure 1.--Mountain pine beetle infestation, Gold Creek, Rexford District, Kootenai National Forest, 1976.

Area of current infestation.

December 1976 to determine tree and volume losses by year, and area involved. Results are presented and provide a basis for implementing the selected management plan.

METHODS

A variable plot cruise (BAF-20) was conducted on 607 ha. Plots were located at 100-meter intervals on cruise lines 100 m apart. Trees 10 cm d.b.h. and larger were recorded by species, diameter at breast height (d.b.h.), and total height, and categorized into the following classes:

0 = green, uninfested.
1 = 1976 attack; green or partially faded foliage, brood in cambium, blue stain present.
2 = 1975 attack; red foliage, brood emerged.
3 = 1974 or prior attack; majority of needles dropped.
4 = unsuccessful attack or pitchout; green foliage, pitch tubes present, brood and blue stain absent.

These data provided tree and volume loss estimates and were analyzed by a modified R-1 timber sales cruise program.

In addition to the variable plot cruise, nine 1/25-ha circular plots were taken to obtain estimates of phloem thickness for each d.b.h. size class 12.7 cm and larger. Representative phloem samples were removed from opposite sides of two lodgepole pine per diameter class per plot. Phloem thickness was measured to the nearest 0.25 mm using a steel ruler. Hypsometers were used to determine trees to be tallied within plots.

RESULTS

Stand description.--Habitat type ranges from *Pseudotsuga menziesii/Linnaea borealis* at lower elevations (ca 914 m) to *Abies lasiocarpa/Clintonia uniflora* and *A. lasiocarpa/Vaccinium scoparium* at higher elevations (ca 1,524 m). Stand composition is lodgepole pine, 61.5 percent; western larch (*Larix occidentalis* Nutt.), 25.6 percent; Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco), 6.1 percent; subalpine fir (*Abies lasiocarpa* (Hopk.) Nutt.), 2.9 percent; Engelmann spruce (*Picea engelmannii* Parry), 2.5 percent. The remaining 1 percent includes grand fir (*Abies grandis* (Dougl.) Lindl.), western white pine (*Pinus monticola* Dougl.), and ponderosa pine (*Pinus ponderosa* Laws).

Intensity of infestation.--Number of infested trees decreased from 12,247 in 1974 to 2,790 in 1975, then increased to 3,941 in 1976 (Table 1). This represents a 1:0.2 ratio of old to newly attacked

trees from 1974 to 1975, and a 1:1.4 buildup ratio from 1975 to 1976. A total of 18,978 trees with an estimated volume loss of 10,210 cu m has occurred during the 3-year period 1974 to 1976. Infested trees averaged 24.4 cm and ranged from 12.7 to 43.2 cm.

Table 1.-- Tree and volume loss estimates caused by the mountain beetle, Gold Creek, Rexford District, Kootenai National Forest, 1974-76.

	Lodgepole pine killed			Volume loss (cu m)	
Year	Avg. d.b.h. (in cm)	Trees per ha	Total	Per ha	Total
1974	22.9	20.3	12,247	10.9	6,589
1975	25.4	4.7	2,790	2.5	1,501
1976	25.4	6.4	3,941	3.4	2,120
Total or Avg.	24.4	10.4	18,978	5.6	10,210

In 1974, 69.7 percent of the infested trees were $\geq$25.4 cm d.b.h.; 90.8 percent were $\geq$ 25.4 cm d.b.h. in 1975; and 78.8 percent were $\geq$ 25.4 cm d.b.h. in 1976 (Table 2). Twenty-seven percent of the residual green stand is $\geq$25.4 cm d.b.h.

Table 2.-- Percent of infested and pitchout trees by diameter class, Gold Creek, Rexford District, Kootenai National Forest, 1974-1976.

Year	D.b.h. size class (cm)												
	12.7	15.2	17.8	20.3	22.9	25.4	27.9	30.5	33.0	35.6	38.1	40.6	43.2
1974	2.5	5.1	3.8	6.3	12.7	25.3	12.7	13.9	8.9	6.3	0	1.3	1.3
1975	0	0	4.5	0	4.5	22.7	22.7	22.7	9.1	13.6	0	0	0
1976	0	0	0	9.1	12.1	30.3	21.2	9.1	12.1	6.1	0	0	0
Pitch-outs	0	0	6.7	13.3	6.7	43.3	16.7	3.3	6.7	3.3	0	0	0

In addition to the estimated 3,941 trees successfully attacked, 4,176 trees were unsuccessfully attacked and classed pitchouts in 1976. Phloem thickness within the stand ranged from 0.05 to 0.51 cm and overall mean phloem thickness was 0.20 cm (Table 3). Of all trees measured in 1976, 78.8 percent were $\geq$ 25.4 cm d.b.h. and 21.9 percent of these had phloem $\geq$0.25 cm.

Table 3.-- Summary of phloem measurement of lodgepole pine, Gold Creek, Rexford District, Kootenai NF, 1976.

D.b.h. (in cm)	Mean phloem thickness (in cm)
12.7	--
15.2	0.14
17.8	.18
20.3	.13
22.9	.15
25.4	.16
27.9	.15
30.5	.21
33.0	.20
35.6	.13
38.1	--
40.6	--
43.2	.51

DISCUSSION

Factors such as phloem thickness, tree diameter, stand density, age, habitat type, and elevation influence stand susceptibility to mountain pine beetle attack (Cole 1973; Safranyik et al. 1974). These factors have been used for hazard rating lodgepole pine stands in British Columbia (Safranyik et al. 1974). A map extending this concept was prepared by the Kootenai National Forest in 1975 (Hamel and McGregor 1976). Hazard ratings were prepared for areas supporting significant lodgepole pine components $\geq$ 60 years of age. Unfortunately, the Gold Creek drainage was omitted from this analysis. Based on criteria used in that analysis, the Gold Creek drainage would have rated Priority 1 and should have received priority management consideration. As a result of current infestation, approximately 19,000 trees have been killed since 1974.

Using buildup ratios from 1974 to 1976, and based on the formula $Y = y + bx$ (Baker 1968) where:

Y = the potential cumulative number of trees killed predicted through 1977
y = the cumulative number of trees killed through this year (1976)
x = number of trees killed in 1976
x_1 = number of trees killed in 1975

$$b = \frac{x}{x_1}$$

it is predicted that 5,756 trees will be killed in 1977. This will bring the cumulative number of trees killed through 1977 to 24,734 with an estimated potential volume loss of approximately 13,201 cu m.

As larger diameter trees (≥20.3 cm) are removed from the stand by beetles or by logging, the infestation should decline. Smaller, thin phloem trees produce fewer and smaller beetles than bettles completing development in larger trees (Safranyik and Jahren 1970). Because phloem is thinner and beetles are smaller, fewer eggs will be deposited (Amman 1972). If logging is not conducted, sufficient large diameter trees exist to continue the outbreak at epidemic level for several years.

Although 38.5 percent of the stand in Gold Creek is composed of species other than lodgepole pine, a sufficient amount of mixed tree species does not exist to alter the infestation trend. Amman and Baker (1972) hypothesize that the proportion of other tree species must be considerably more than 36 percent in the elevational zone of optimal beetle development for lodgepole pine in a mixed species forest to be less susceptible to mountain pine beetle damage.

RECOMMENDATIONS

The Rexford District proposed three alternatives for management of lodgepole pine in the Gold Creek drainage. They are:

1. Allow stands to remain in their natural state.
2. Remove the susceptible (80 years +) lodgepole pine component.
3. Harvest stands most susceptible to beetle attack.

The area, situated on the shores of Lake Koocanusa and visible from Highway 37, is recognized as having high esthetic value. Therefore, timber harvests or other vegetative manipulation for mountain pine beetle management should be designed to maintain or improve this significant viewing resource.

Alternative 1 does not provide for maintenance of esthetic values. Although the present view would be maintained for a short time, as the infestation progresses more trees would be killed and the visual impact could be altered considerably. Tree mortality would result in increased fuel buildup creating greater fire potential.

Possible benefits from this alternative would be: allowing plant succession to proceed resulting in elimination of lodgepole pine and mountain pine beetle from the stands; increased understory development providing browse for ungulates, berries and nesting cover for birds, greater water retention, more snags and downfall, providing perches and nesting sites for birds, and bedding and cover for bears.

Alternative 2 proposes a selective harvesting plan and would result in short-term impacts on the visual resources as road construction and logging activity alter the visual situation. Because mountain beetle shows preference for older large diameter trees, selective cuts directed at these trees would greatly reduce infestation potential (Amman et al. In Press).

The District indicates this alternative would increase runoff, water yield, and sedimentation, especially on steeper slopes. Fuel loading would increase significantly and would have to be abated through fire or mechanical means. Site preparation and fuel abatement measures would lead to regeneration of a new stand of trees dominated by species other than lodgepole. The western larch component would probably be high since it is currently the second most numerous tree, comprising more than 25 percent.

Alternative 3 proposes a concentrated effort to harvest only those stands most susceptible to beetle attack. Removing the lodgepole component from prime habitat stands will result in less acreage harvested and reduce the visual impact. This limited harvest proposal will reduce impact on soil, water, and fuel increases in comparison to alternative 2. This treatment may not meet silvicultural needs of these stands, since the dominant, more productive lodgepole would be removed. Smaller diameter lodgepole (13-18 cm d.b.h.) are numerous in the drainage, and are generally in a stagnated condition. Removal of small diameter trees could be delayed since they are not as susceptible to beetle attack. This alternative would serve to break up continuous lodgepole pine stands with smaller cuts resulting in different age and size classes, thereby reducing the area likely to be infested at any one time. As uncut patches become susceptible, trees could be harvested immediately.

The most effective method of suppressing the mountain pine beetle is through a combined program of logging infested trees and timely silvicultural treatment to remove or reduce the inventory of large diameter, susceptible trees. Alternatives 2 and 3 allow for this and follow approved guidelines for reducing losses of lodgepole pine to mountain pine beetle (Amman et al. In Press). It is therefore recommended that both alternatives 2 and 3, and the results of this bioevaluation be discussed in detail with the Forest silviculturist and other resource personnel, including the Forest Insect and Disease Management staff. Implementation of a management plan should follow as soon as possible.

REFERENCES CITED

Amman, G.D. 1972. Mountain pine beetle brood production in relation to thickness of lodgepole pine phloem. J. Econ. Entomol. 65:138-140.

Amman, G.D. and B.H. Baker. 1972. Mountain pine beetle influence on lodgepole pine stand structure. J. Forest. 70:204-209.

Amman, G.D., M.D. McGregor, D.B. Cahill, and W.H. Klein. In Press. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in the Rocky Mountains.

Baker, B.H. 1968. The use of "buildup ratio" as indication of mountain pine beetle population trends. Branch of Insect and Disease Prev. and Control, Fire Management, USDA Forest Serv., Ogden, UT. Office Rept., 6 pp.

Cole, D.M. 1973. Estimation of phloem thickness in lodgepole pine. USDA, Forest Serv., Res. Paper INT-148, 10 pp.

Hamel, D.R., and M.D. McGregor. 1976. Evaluation of mountain pine beetle infestations; Lap, Cool, Lang, and Caribou drainages, Yaak Ranger District, Kootenai National Forest, Montana. USDA, Forest Serv., Forest Environ. Prot., Missoula, MT. Rept. 76-6, 10 pp.

Safranyik, L. and R. Jahren. 1970. Host characteristics, brood density and size of mountain pine beetles emerging from lodgepole pine. Dept. of Fisheries and Forestry of Canada, Bi-monthly Res. Note 26:35-36.

Safranyik, L., D.M. Shrimpton, and H.S. Whitney. 1974. Management of lodgepole pine to reduce losses from the mountain pine beetle. Can. Dept. of Environ.